UNITED STATES MARINE CORPS
Logistics Operations School
Marine Corps Combat Service Support Schools
Training Command
PSC Box 20041
Camp Lejeune, North Carolina 28542-0041

AOM 6308

STUDENT HANDOUT

AUTOMOTIVE TEST EQUIPMENT OPERATING PROCEDURES

LEARNING OBJECTIVE

1. Terminal Learning Objective: Given an operational diesel engine for use as a test medium, a student handout entitled, "Automotive Test Equipment Operating Procedures," a test light, anti-freeze and battery tester, pressure cooling system tester, and a belt tension gage, use each item of test equipment to perform representative tests on the test medium, per information contained in the student handout provided. (6.3.9)

2. Enabling Learning Objectives: Given an operational diesel engine for use as a test medium, a student handout entitled, "Automotive Test Equipment Operating Procedures," a test light, anti-freeze and battery tester, pressure cooling system tester, and a belt tension gage, per information contained in the student handout provided:

a. measure drive belt tension, (6.3.9a)

b. pressure test the cooling system, (6.3.9b)

c. test the pressure cap, (6.3.9c)

d. measure battery specific gravity, (6.3.9d)

e. check coolant protection level, and (6.3.9e)

f. determine presence of voltage. (6.3.9f)

OUTLINE

1. AUTOMOTIVE TEST EQUIPMENT

a. Belt Tension Gage. (Figure 1.) This is a belt tension gage. This device will allow the mechanic to perform an accurate check and adjustment of drive belt tension.

(1) Drive belts that are too tight will cause bearing failure and excessive wear on the components they are driving. Belts that are too loose will slip and cause the components the belts are supposed to be driving to function improperly or not at all.

(2) Always consult the appropriate technical manual for specifications, prior to making a belt adjustment.

(3) Drive belt adjustment should only be made if the belt tension is not within specifications listed in the technical manual.

(4) Belt tension should be checked when the belt is hot and allowed to cool before retensioning.

(5) The procedures for testing belt tension are as follows:

(a) First, depress the plunger fully so the hook will engage the belt.

(b) Next, release the plunger and read the belt tension indicated opposite the indicating point above the dial.

(c) If the belt tension is within specifications, remove the belt tension gage by depressing the plunger and moving the gage away from the belt. Release the plunger slowly when the gage is off the belt. Letting it snap back will result in damage to the belt tension gage.

(d) If the belt tension is not within specifications, remove the gage as previously described and adjust the belt.

b. Pressurizing Safety and Pressure Caps

(1) If the cooling system was not pressurized, the coolant would boil at about 212 degrees Fahrenheit. By pressurizing the system, the coolant temperature can be raised to about 260 degrees without boiling. This higher temperature allows the cooling system to operate more efficiently.

(2) At one time or another, all of us have accidently burned ourselves. You do not know what pain is, until you have been scalded by a pressurized cooling system.

(a) As stated earlier, coolant under pressure reaches very higher temperatures. This hot coolant under pressure can spew out and burn you severely, leaving you permanently scarred.

(b) Before you remove any cooling system pressure cap, always make sure the system is cool or depressurize the system to prevent injury.

(3) Pressurization of the cooling system is accomplished by the use of a spring loaded cap that maintains pressure within the system.

(a) The pressure cap (Figure 2.) is equipped with a built-in pressure control valve which seals off the cooling system from the overflowtube, permitting the system to pressurize itself automatically as the coolant expands as it is heated. The pressure will not exceed the specified rating of the pressure cap, providing the cap is functioning properly.

(b) This Cap (Figure 3.) is stamped with the number fifteen. This means that the pressure valve of this cap should not open below fifteen pounds of pressure, but must open before seventeen pounds of pressure is reached.

(Figure 2.) Pressure Cap

(Figure 3.)
15 PSI Pressure Cap

c. (Figure 4.) This is a pressurized cooling system tester. It will pressurize the cooling system to twenty pounds per square inch,

allowing you to check for leaks when the system is cool. The tester is also used to test the pressure cap for serviceability. Due to the two different sizes of radiator filler necks and radiator caps used in the cooling system of our tactical wheeled vehicles, an adapter kit is provided with the tester.

(1) To test the radiator pressure cap, carefully remove the cap from the neck of the radiator and check the pressure rating of the cap. Remember our cap is rated at fifteen pounds per square inch.

(2) To be sure you have the proper rated cap, check the rating of the cap with the recommended rating in the technical manual for the vehicle.

(Figure 4.)
Pressure Cooling System Tester

(3) Next, make sure all parts and seating surfaces of the pressure cap and adapter are clean.

(4) Now, apply the pressure cap to one end of the adapter and attach the other end of the adapter to the pressure tester by pressing together the rotating adapter until the locking ears contact the stops on the adapter cams.

(5) Then, hold the tester with the gage facing you (Figure 5.) and operate the pump until the needle reaches its highest point. Stop pumping when the valve opens and read the gage.

(Figure 5.) Testing Pressure Cap

(a) (Figure 6.) Notice there are yellow, green, blue, black, and red color bands on the gage. Each color band represents a pressure reading.

(b) Our pressure cap is rated at fifteen pounds. The color band for this pressure reading is black.

(Figure 6.) Pressure Gage

(6) The needle must be within the proper color band for the pressure rating of the cap when the pressure valve opens.

(7) The cap is satisfactory when the pressure holds steady or falls very slowly, but holds within the color band for one minute or more.

(8) If the pressure falls comparatively fast or doesn't hold at all, replace the cap.

d. To pressure test the cooling system (Figure 7.), carefully remove the pressure cap and make sure the coolant is at the proper level.

(1) Clean the inside of the filler neck and make sure there are no nicks, dents or bumps on the seating surface.

(2) Inspect the overflow tube for dents, crimps and obstructions. Inspect for bent cams on the outside of the filler neck.

(3) To attach the pressure tester, set the tester on the filler neck with the locking ears in

(Figure 7.)

line with the entrance notches of the filler neck Testing Cooling System filler neck. Press down slightly and turn clockwise until the locking ears are stopped by the lugs on the filler neck.

(4) Check the appropriate technical manual to determine the recommended pressure for the system.

(5) After attaching the tester, pump the handle until the prescribed pressure is indicated on the gage. To prevent cooling system damage, never exceed the recommended pressure.

(6) If the pressure reading holds steady for two minutes, there are no serious leaks in the system. However, this is the time to check the entire cooling system for seepage or slight leaks and check the hoses for bulging.

(7) If the pressure reading drops slowly, that indicates the presence of small leaks or seepage. Check the radiator, hoses, and gaskets.

(8) If the pressure reading drops quickly, serious leakage is present.

(9) Before removing the tester, always release the pressure in the cooling system by pressing the stem to one side (Figure 8.).

(Figure 8.)
Releasing the Pressure

e. This refractometer (Figure 9.), which is an AO Duo-Chek, is designed specifically for rapid and accurate checking of the permanent anti-freeze protection level and battery state of charge. (Figure 9.) Coolant and Battery

Tester

(Figure 10.) The tester should be cleaned before and after each use. To do so, swing back the plastic cover at the slanted end of the tester, exposing both the measuring window and the bottom of the plastic cover. Then, wipe the window and cover clean and dry with tissue or a clean soft cloth and close the plastic cover.

(Figure 10.)
Clean the Eyepiece

(1) To obtain a coolant sample (Figure 11.), release the plastic hose of the AO Duo-Chek an insert the hose into the surge tank well belo the coolant level. Press and release the bulb to draw up a sample of coolant.

(Figure 11.)
Drawing Sample of Coolant

(a) Next (Figure 12.), bend the plastic tube around the tester so the tip can be inserted in the cover plate opening. Eject a few drops of coolant into the measuring surface by pressing the bulb.

(Figure 12.)
Eject Coolant

(b) Now, point the instrument toward any light source and look into the eyepiece (Figure 13.) The anti-freeze protection reading is at the point where the dividing line between the light and dark line crosses the scale. The anti-freeze

scale is on the right and the battery electrolyte is on the left.

(Figure 13.)
Reading Anti-freeze Scale

(2) To measure specific gravity with the tester, swing the plastic cover down until it rests against the measuring window and using the black dipstick (Figure 14.), place a few drops of electrolyte from a battery cell onto the exposed portion of the measuring window.

(Figure 14.)

(a) (Figure 15.) Now, point the tester toward a bright light source. When you look through the eyepiece lens, you'll see a rectangle with two calibrated scales. The battery state of charge reading is on the left scale.

(b) The electrolyte sample will divide the rectangle with an area of light and an area of shadow. You read the scale where they meet.

(Figure 15.)
Reading

(d) A full charge is 1.280 specific gravity for our electrolyte.

(e) Clean the tester after testing each remaining cell and before storing the instrument.

f. Test Light. (Figure 16.) To find out if voltage is present, we can use the test light. The keyword is "present," not how much voltage.

(1) Before attempting to locate an electrical problem with the test light, always check to be sure the light is good.

(2) Using a charged battery, touch the alligator clip to one of the battery terminals, and touch the probe to the other terminal. If the test light doesn't go on, change the bulb.

(3) When using the test light, you do not have to be polarity conscious. What I mean is, you can connect the clip or touch the probe to either a current carrying wire or a ground; it doesn't matter.

(4) Always make sure the ignition switch and the switch for the suspect circuit are in the "ON" position.

(5) Testing for presence of voltage is usually done from connecting point to connecting point, starting at the battery and testing toward the fault.

(6) If the distance between electrical connecting points is too great, you may have to probe for voltage.

(7) Since at least one wire that goes to the faulty component has to carry current, you can test for its presence by connecting the alligator clip to a good ground and gently inserting the tip of the probe into the wire.

(8) If the test light goes on, you have located voltage. If there is no light, there is a break in the circuit and you should test another section of the circuit closer to the power source.

REFERENCES: Manufacturer's Operating Instructions for items of equipment specifically addressed in this lesson.